Introduction

Background: Fish consumption can be a significant source of lipophilic contaminants, such as polychlorinated biphenyls (PCBs).These contaminants can concentrate in human milk resulting in the nursing infant being at the pinnacle of the human bioconcentration food chain. Risk to infants from consuming the milk of mothers who eat contaminated fish has not been quantitatively addressed in the fish advisory process. In the case of PCBs, EPA guidance for fish advisory programs uses the oral reference dose for Aroclor 1254 to establish the allowable fish consumption rate for children and adults who eat fish. This method does not account for the significant bioconcentration in the adipose of an expectant mother that will be mobilized and incorporated into breast milk. To adequately protect this most vulnerable population, the nursing infant, this dose from milk consumption should be considered when developing fish advisories and assessing risk at sites where lipophilic contaminants are present.

Obtaining human milk samples to measure contaminant concentrations is not practical in most cases, so it is desirable to have a method to estimate milk concentrations based on a lifetime average daily dose to the mother. Multiple models have been developed to produce these estimates. Here, we compare adaptations of 3 published models[1-3] as to their ability to predict human milk concentrations. The Haddad model is an 8-compartment physiologically-based pharmacokinetic (PBPK) model that has been validated by comparing estimated milk concentrations against concentrations measured in a Canadian Inuit population[1]. The Yang model is a 3-compartment PBPK model[2], and the EPA model is a single compartment, classical pharmacokinetic model[3, 4].

We compared models by selecting 8 individuals from the data set provided by Sami Haddad who breast fed for at least 11 months and represented a spread of average daily doses of the PCB congener 153 (PCB-153). Simulated milk concentrations from each of the 3 models for the selected individuals were similar within a factor of 2. EPA's model, the simplest, consistently produced milk concentration estimates that were the highest of the 3 models but still within a factor of 2 (See Table 1 and Figures 1 and 2) of the validated Haddad model. This suggests that the EPA model is accurate and protective and may be a good choice for risk assessors and fish advisory practitioners.